WE CLAIM:

1. A fiber laser, comprising:

A gain fiber less than 5cm in length including,

A core formed from a glass host selected from germanate, tellurite or fluoride, said glass host being doped with 0.5-15 wt. % of thulium or holmium oxide or mixtures thereof; and

A cladding formed from the same glass host;

A narrowband grating having a linewidth and a broadband grating at opposite ends of the fiber that define an optical resonant cavity; and

A source of pump radiation that illuminates the fiber to excite the dopant ions and provide gain;

the length of the resonant cavity producing a mode spacing that is comparable with the narrowband grating's linewidth so that the dopant ions lase at a single longitudinal mode, said fiber laser outputting a single-frequency signal having a center wavelength between approximately 1.8 μm and 2.1 μm with a linewidth less than 100 kHz.

2. The fiber laser of claim 1, wherein the glass is doped with 1-8 wt. % thulium or holmium oxide.

3. The fiber laser of claim 1, wherein the linewidth of the single-frequency signal is less than 10 kHz.

4. The fiber laser of claim 1, wherein the narrowband and broadband gratings are formed in sections of passive silica fiber that are fusion spliced to the ends of the gain fiber.

5. The fiber laser of claim 1, wherein the pump includes a section of polarization maintaining fiber.

6. The fiber laser of claim 1, wherein the multi-component glass includes the following ingredients by weight percentages,

a network former of 30 to 85 percent, where the network former is selected from germanate-oxide (GeO_2) or tellurite-oxide (TeO_2),

a glass intermediator L_2O_3 of 0.5 to 50 percent, where L_2O_3 is selected from Al_2O_3, B_2O_3, Y_2O_3, La_2O_3, WO_3 and mixtures thereof, and

a glass modifier of 2 to 50 percent including (a) MO of 0 to 20 percent, where MO is selected from BaO, BeO, MgO, SrO, CaO, ZnO, PbO, and mixtures thereof, and (b) R_2O of 0 to 20 percent, where R_2O is selected from Na_2O, Li_2O and K_2O and mixtures thereof.

7. The fiber laser of claim 6, wherein the glass includes by weight percentages,

45 to 70 GeO_2;

0.5 to 20 L_2O_3;

2 to 20 MO; and

2 to 30 R_2O,

wherein L_2O_3 is selected from Al_2O_3, B_2O_3 and La_2O_3 and MO is selected from BaO, CaO and MgO.

8. The fiber laser of claim 6, wherein the glass includes by weight percentages,

45 to 85 TeO_2;

0.5 to 15 L_2O_3; and

0.5 to 20 R_2O,

wherein L_2O_3 is selected from Al_2O_3, B_2O_3 and La_2O_3.

9. The fiber laser of claim 6, wherein the glass includes by weight percentages,

45 to 85 TeO_2;

10 to 45 WO_3; and

0.5 to 20 R_2O.

10. The fiber laser of claim 1, wherein the gain fiber is less than 5cm in length.

11. The fiber laser of claim 1, wherein the gain fiber is a polarization maintaining (PM) fiber.

12. The fiber laser of claim 11, wherein the polarization whose stimulated emission cross section of the gain fiber is higher is aligned to the orientation of the operating polarization of the narrow-band fiber Bragg grating.

13. The fiber laser of claim 1, wherein the narrowband grating has a linewidth less than 0.07 nm and the broadband grating has a linewidth between 0.07 nm and 0.4 nm.

14. The fiber laser of claim 11, wherein the mode spacing is greater than 0.07 nm.

15. A fiber laser, comprising:

A gain fiber less than 5cm in length including,

A cladding formed from fluoride, germanate or

tellurite glass host; and

A single mode core formed from the same glass host doped with 0.5-15% thulmium or holmium oxide or mixtures thereof;

A passive silica fiber having a narrowband grating formed therein and fused at one end of the gain fiber;

A passive silica fiber having a broadband grating formed therein and fused at the other end of the gain fiber; and

A source of pump radiation that illuminates the fiber so that said fiber outputs a single-frequency signal having a center wavelength at approximately 2 μm.

16. The fiber laser of claim 15, wherein the glass is doped with 1-8 wt. % thulmium or holmium oxide.

17. The fiber laser of claim 15, wherein the glass includes by weight percentages,

a network former of 30 to 85 percent, where the network former is selected from germanate-oxide (GeO_2) or tellurite-oxide (TeO_2),

a glass intermediator L_2O_3 of 0.5 to 50 percent, where L_2O_3 is selected from Al_2O_3, B_2O_3, Y_2O_3, La_2O_3, WO_3 and mixtures thereof, and

a glass modifier of 2 to 50 percent including (a) MO of 0 to 20 percent, where MO is selected from BaO, BeO, MgO, SrO, CaO, ZnO, PbO, K_2O, Li_2O and mixtures thereof, and (b) R_2O of 0 to 20 percent, where R_2O is selected from Na_2O, Li_2O and K_2O and mixtures thereof.

18. The fiber laser of claim 15, wherein the source of pump

radiation and/or the gain fiber includes a polarization maintaining (PM) fiber.

19. The fiber laser of claim 15, wherein the narrowband grating has a linewidth less than 0.07 nm and the broadband grating has a linewidth between 0.07 nm and 0.4 nm, said narrowband and broadband gratings forming a resonant cavity less than 5cm in length with a mode spacing that is greater than 0.07nm so that said single-frequency signal has a linewidth less than 10 kHz.

20. A fiber laser, comprising:

A gain fiber less than 5cm in length including,

A core formed from an oxide-based multi-component glass host including by weight percentage a network former of 30 to 85 percent selected from germanate-oxide (GeO_2) or tellurite-oxide (TeO_2), a glass intermediator L_2O_3 of 0.5 to 50 percent selected from Al_2O_3, B_2O_3, Y_2O_3, La_2O_3, WO_3 and mixtures thereof, and a glass modifier of 2 to 50 percent including (a) MO of 0 to 20 percent selected from BaO, BeO, MgO, SrO, CaO, ZnO, PbO, K_2O, Li_2O and mixtures thereof, and (b) R_2O of 0 to 20 percent selected from Na_2O, Li_2O and K_2O and mixtures thereof, said glass host being doped with 0.5-15 weight percent thulmium or holmium oxide or mixtures thereof; and

A cladding formed from the same glass host;

A narrowband grating at one end of the fiber;

A broadband grating at the other end of the fiber; and

A source of pump radiation that illuminates the fiber so that the dopant oxide ions lase at a single longitudinal mode and said fiber outputs a single-frequency signal having

a center wavelength at approximately 2 μm.

21. The fiber laser of claim 20, wherein the narrowband and broadband gratings are formed in sections of passive silica fiber that are fusion spliced to the ends of the gain fiber.

22. The fiber laser of claim 21, wherein the narrowband grating has a linewidth less than 0.07 nm and the broadband grating has a linewidth between 0.07 nm and 0.4 nm, said narrowband and broadband gratings forming a resonant cavity less than 5cm in length with a mode spacing that is greater than 0.07nm so that said single-frequency signal has a linewidth less than 10 kHz.

23. The fiber laser of claim 20, wherein the single-mode signal has a linewidth of less than 10 kHz.

24. The fiber laser of claim 20, wherein the glass is doped with 1-8 wt. % thulium or holmium oxide.

25. The fiber laser of claim 20, wherein the glass includes by weight percentages,

45 to 70 GeO_2;

0.5 to 20 L_2O_3;

2 to 20 MO; and

2 to 30 R_2O,

wherein L_2O_3 is selected from Al_2O_3, B_2O_3, La_2O_3 and MO is selected from BaO, CaO and MgO.

26. The fiber laser of claim 20, wherein the glass includes by weight percentages,

45 to 85 TeO_2;

0.5 to 15 L_2O_3; and

0.5 to 20 R_2O,

wherein L_2O_3 is selected from Al_2O_3, B_2O_3, La_2O_3.

27. The fiber laser of claim 20, wherein the glass includes by weight percentages,

45 to 85 TeO_2;

10 to 45 WO_3; and

0.5 to 20 R_2O.